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A note on 244 MHz scintillation

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Scintillation of transionospheric radio signal is extensively used to understand the physics of the ionosphere. Through multitechnique studies, association of these events with the ionospheric irregularities manifested in the form of spread-F and Es is now more or less established. In this communication, the temporal behaviour of 244 MHz scintillation recorded at Guwahati (26.3°N geog, 91.75°E, 15.16°N geom, dip 37°) is reported and a few distinctive features in association with ionospheric irregularities are brought out. The analysis presented here is mainly for a low solar activity year of 1985.

For studying the seasonal character, the scintillation are classified as night-time and daytime ones and Figure 1 shows the occurrence percentage of nocturnal scintillation (for SI > 1 db) during different months. The occurrence probability which shows a distinct maximum during local summer goes down as summer recedes and no scintillation is recorded during the winter months. This trend is very prominent from September when occurrence falls sharply from 20% in August to 3.5% in September. On the otherhand, summer minimum in scintillation activity at this frequency and in a declining solar activity period was reported from Calcutta (Maitra *et al* 1984) a station situated only 3 degree south and west of Guwahati. The 244 MHz scintillation records from Bombay (Koparkar and Rastogi 1985) also reveal a low activity during local summer in a low solar epoch. A summer minimum in scintillation in equatorial Indian and American sectors is by now well reported and known. But the changes in the seasonal scintillation behaviour as one goes away from Calcutta (88.5°E) to Guwahati is to be noted with interest.

Solar control on seasonal scintillation pattern is then examined by plotting mean sunspot number along with the percentage occurrence of scintillation as shown in Figure 1. There is no appreciable variation of sunspot number during the observation period as can be seen from Figure 1. The markedly high value of scintillation occurrence during summer may therefore be considered to have no relevance to the solar activity. Clear records of high occurrence of scintillation at 136 MHz during summer (for a high solar epoch) are also available for Guwahati. In support of the observation at 244 MHz, the scintillation occurrence percentage at 136

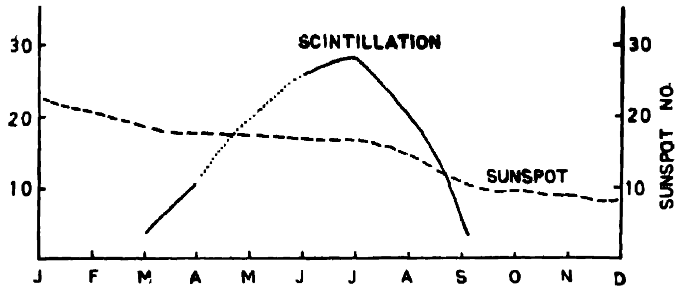

Figure 1. Occurrence percentage of nocturnal scintillation (SI > 1 db) for 244 MHz at Guwahati. Corresponding sunspot number is shown by broken line.

MHz is therefore presented in Figure 2 along with the corresponding sunspot number. No solar activity control on the seasonal behaviour of scintillation is evident from the figure. The observed variation of scintillation at Guwahati can

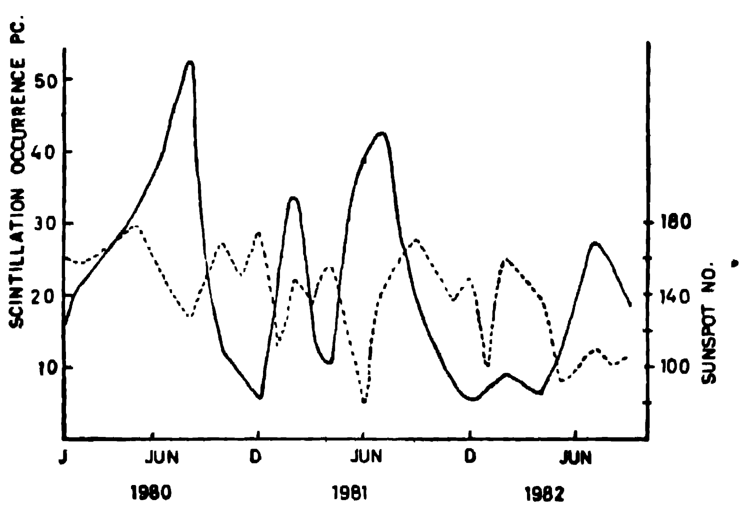

Figure 2. Occurrence percentage of nocturnal scintillation (SI 1 db) for 136 MHz at Guwahati. Corresponding sunspot number is shown by broken line.

therefore be considered to be seasonal and always reaches a peak during summer at least during the observation period. However overall occurrence probability of scintillation goes down with the decrease of solar activity.

The diurnal scintillation behaviour indicates that though this event is basically nocturnal, daytime scintillation can never be neglected specially during the summer. A sample plot of diurnal scintillation pattern at 244 MHz is presented in Figure 3. The pre-midnight scintillation activity is observed to be prominent with a secondary nocturnal peak in the post midnight hours. Relatively large occurrence of scintillation during noon hours is significant. This daytime scintillation occurrence percentage is even comparable to that observed during a high solar activity period and at a much lower frequency of 136 MHz. A sample plot of 136 MHz scintillation event for the month of August, 1981 is therefore presented along with that of 244 MHz (Figure 3b). A point to be mentioned is that the fade depth recorded at

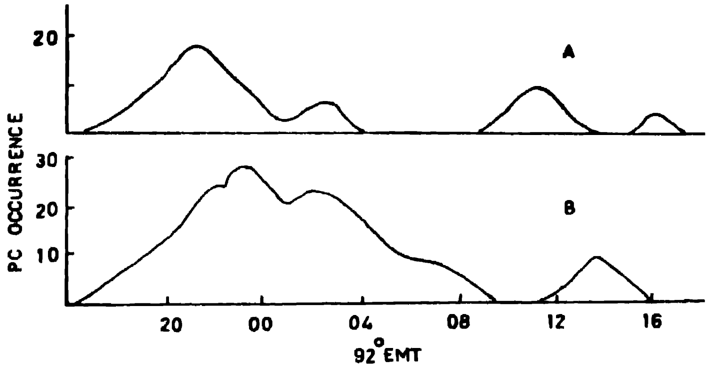

Figure 3. Scintillation occurrence percentage diurnal variation at 244 MHz fo August 1985 (A) and at 136 MHz for August 1981 (B).

244 MHz generally varies between 2 to 4 db, but relatively few nighttime cases show fade depths > 10 db. However, a series of shipboard observations at 250 MHz made at a high solar epoch by Goodman and Martin (1982) covering latitudes from equator to anomaly regions in the American sector shows a fade depth of about 25 db at similar magnetic latitude stations as that Guwahati. This fade depth is significantly high compared to that recorded at Guwahati with 244 MHz RB. Indeed, this fade depth of 25 db is more intense than what is observed even at 136 MHz at this station.

It was also observed from the analysis of 136 MHz RB record during 1979-81 and ionosonde data taken at Guwahati that summer nighttime scintillation bears a positive relationship with spread F (Devi and Barbara 1985). They have also shown a remarkable association between post midnight scintillation with frequency type of spread F. Because of non availability of ionosonde data at Guwahati during the present period of observation, there is no scope for directly associating 244 MHz scintillation with spread F. But the fact that spread F activity at Guwahati increases with decrease of solar activity and that spread F event enchances two-fold for a decrease of sunspot number by a factor of five, it is believed that the large percentage of scintillation seen at 244 MHz during summer night to be of spread F origin.

The events of large daytime scintillation at low solar activity period as seen during the present analysis have also been observed at Calcutta (Maitra et *al* 1984) for a declining solar activity condition. Though there could be a number of sources that trigger scintillation, many investigators (Das Gupta and Kersley 1976, Rastogi 1982) have reported a fair degree of correlation between daytime scintillation and Es. Using orbiting satellite, Devi and Barbara (1978) attributed the occurrence of daytime scintillation to Es. A significant association between daytime scintillation at 136 MHz signal at this station and Es is also seen at high solar epoch (Figure 4).

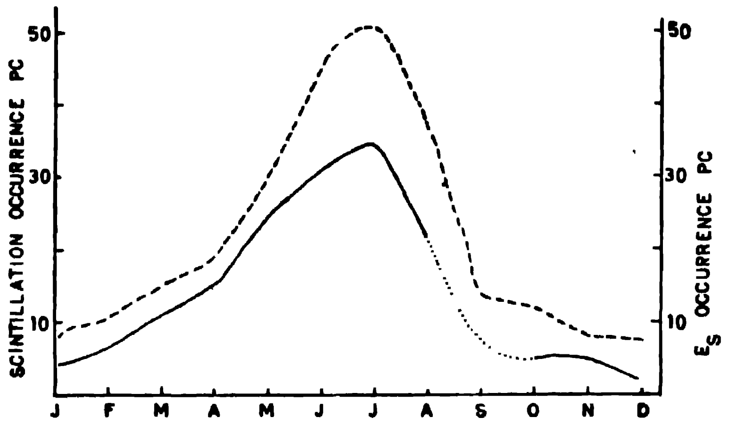

Figure 4. Daytime scintillation at 136 MHz (solid line) at a high solar epoch and occurrence percentage of Es (> 5 MHz) taken at Guwahati.

But the increase of Es events with solar activity (Talukdar 1981) is in contrast with the inverse relation between these two parameters seen at a number of low and mid latitude stations (Bowman 1985). From the analysis on the various types of Es seen at this station, it has however been observed that occurrence of constant height type Es is 10% higher at a low solar activity period relative to that at high solar epoch. Scintillation even at UHF range is found to have association with constant height type Es. Working at Brisbane, Hajkowicz (1978) has obtained a very good correspondence between constant height type Es and daytime scintillation at VHF and UHF ranges when spread F was absent. It is therefore, reasonable to reconcile such Es events with daytime scintillation at 244 MHz seen at Guwahati.

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